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The five hundred and twenty-sixth meeting of the Club was held at the Rembrandt Hotel, London, on the 18th May, 1965.

Chairman: Mr. R. S. R. Fitter

Members present 20; Guests 2.

Dr. W. R. P. Bourne has kindly sent the ensuing paper on the subject of the talk given by him at this meeting:

The missing petrels

Introduction

Two populations of petrels are currently thought to be extinct through the depredations of introduced predators at their island breeding stations, the Guadelupe Storm-petrel *Oceanodroma macrodactyla* and the Jamaica Petrel *Pterodroma (hasitata) caribbaea*. In addition since the war some five forms which had also with varying degrees of confidence been pronounced extinct have been rediscovered, the Short-tailed Albatross *Diomedea albatrus*, the Hawaiian Shearwater and Petrel *Puffinus puffinus newelli* and *Pterodroma phaeopygia sandwichensis*, and the Bermuda and Capped Petrels *Pterodroma (h.) hasitata* and *P. (h.) cahow*. Three new discoveries have also been reported, Murphy's Petrel *Pterodroma ultima* in 1949 (*Ornithologie als biologische Wissenschaft* (Festschrift zum 60. Geburtstag von Erwin Stresemann), Heidelberg, p. 89), and two by C. Jouanin, *Bulweria fallax* from the Arabian Sea in 1955, and *Pterodroma baraui* from Réunion in 1964 (*Oiseau* 25: 155; *Bull. Mus. Nat. Hist. Nat. Paris* 35: 593).

The new forms all appear to be rather numerous, and were first collected long before they were recognised as distinct. The Capped Petrel also proves quite common in the inland cliffs of Hispaniola (D. Wingate, *Auk* 81: 147), and judging by observations at sea the Hawaiian Shearwater and Petrel could still be quite common there as well, though not yet reported breeding in strength (F. Richardson and D. H. Woodside, *Condor* 56: 323; F. Richardson, *Auk* 81: 147). On the other hand, the Bermuda Petrel, lost for three centuries on a tiny overcrowded archipelago, was reduced to a handful of aged birds in imminent danger when it was rediscovered, while the Short-tailed Albatross probably only survives at all because immature birds were away at sea when the breeding place on Torishima in the Bonins was devastated first by feather hunters and then by a volcanic eruption (accounts in the *Handbook of North*

American Birds, vol. 1, ed. R. S. Palmer, 1962, New Haven and London). Thus it appears that there are still many things to be discovered about the petrels, and when they are known, urgent action may be required to protect them.

In the course of a survey of the group I have repeatedly been impressed by intriguing gaps in the available information about them, gaps apparently due to inadequate investigation which could soon be filled by intelligent exploration. It may be useful to summarise some of them here in the hope of directing ornithological curiosity in a direction where it is much needed.

1. *The fossil record.*

This has seldom been put first in summaries of directions where investigation is most required in recent times, but this difficult field is one where important information is still very urgently needed. Nothing is known about the history of the Procellariiformes before the appearance of some near-modern types in the middle Tertiary deposits of North America and Europe, although it seems a reasonable deduction from their present distribution that they originated in the southern hemisphere. Fossil penguins have already been discovered in several regions there which add greatly to our understanding of the past history of that group, and fossil petrels are surely to be expected as well. There at least seems a strong case for a most diligent search for them.

Ancient fossil petrels may be hard to find, since the main colonies have probably always been on oceanic islands with a geologically short life, and the older islands may long have vanished under the sea. But there is still much to be learnt about the comparatively recent history of the group, because their distribution must have changed dramatically in even the comparatively recent past with the wild fluctuations in climate in the Pleistocene, while in the last few hundred years the populations of whole archipelagoes have been wiped out by man and introduced predators, notably rats, the mongoose, cats, and hogs. The nature of the natural seabird communities of these islands can only be discovered by a study of their bone deposits, and these are commonly still extremely abundant if searched for in the right way. Examples of what can be discovered by an examination of these deposits are provided by the first revelation of whole extinct petrel communities in the bone deposits of Bermuda, St. Helena, St. Paul and Amsterdam Islands, or the Chatham Islands (R. W. Shufeldt, *Ibis* 1916: 623; W. R. P. Bourne, *Ibis* 99: 94, *Bull. Brit. Orn. Cl.* 76: 126; N. P. Ashmole, *Ibis* 103b: 390; C. Jouanin and P. Paulian, *Proc. XII Int. Orn. Congr. Helsinki* 1958: 368; W. R. P. Bourne, *Notornis* 11: 139).

Thus anyone who chances to visit remote islands can expect to collect information of the very greatest interest and value by a search for ancient bone-beds dating back before the first human occupation. These may or may not be easy to find. In the first place the deposits may have been laid down in the vicinity of the original colonies on offshore islets, coastal or inland cliffs, or exposed slopes, but they may have been removed from these more obvious sites by cultivation and erosion. In consequence, so far the best results appear to have been obtained in caves, followed by wind or water-borne stratified deposits in hollows and gulleys, and then in swamps, though acid water often dissolves at least the smaller bones here. Stratified deposits offer outstanding opportunities for investigation

the sequence of colonisation and extinction of different species on an island, of course, if deposits are excavated carefully according to archaeological techniques (always remembering that petrels burrow); yet so far no advanced work of this type appears to have been attempted anywhere. It seems high time surveys of this type were carried out on all oceanic islands. Failing prehistoric material, much may also be learnt from an examination of the middens left by early human colonists.

2. "Lost" species.

The Cahow was first rediscovered in recent times in Bermuda bone-beds and almost simultaneously through a single stray specimen, and it was then many years before the appearance of others precipitated the systematic search which led to the discovery of the last surviving colony (R. C. Murphy and L. S. Mowbray, *Auk* 68: 266; D. B. Wingate, in Palmer, *loc. cit.*). The same situation in different stages of development is clearly also occurring with a number of other species on different islands elsewhere, and it may be useful to list them as a stimulus to further investigation:—

(1) *The petrels of the St. Helena bone-beds.* Ashmole (*loc. cit.*) lists at least two shearwaters of the genus *Puffinus* and two gadfly petrels of the genus *Pterodroma* which are not known there today from the St. Helena deposits. The remains resembling those of the Wedge-tailed Shearwater *Puffinus pacificus* and the smaller gadfly petrel appear ancient, and may date back to past geological epochs, but those of the smaller shearwater and at least one larger gadfly petrel are abundant and appear quite recent, and it seems likely that they must have survived at least until the period of human colonisation. There are steep coastal cliffs and offshore islets where they may still exist, and if so both of them, and especially the gadfly petrel may belong to endemic forms, or alternatively, judging by its size and the fairly close relationship which appears to exist between the seabirds of the South Atlantic and Indian Ocean, the latter might be one of the two little-known species of Réunion, *Pterodroma aterrima* and *P. baraui*.

(2) The Fiji Petrel *Pterodroma macgillivrayi*. This is a small, heavily built black gadfly petrel still known only from a single fledging male collected at Ngau, Fiji, in October 1855, now in the British Museum (Natural History). It has been referred to the genus *Bulweria* in the past, but its external form is that of a typical *Pterodroma*, with proportions rather like the much larger Tahiti Petrel *Pterodroma rostrata* which nests in the mountains of other central Pacific archipelagoes. Nothing has been heard of it now for over a century, but then nobody seems to have looked for it carefully either; even the members of the Whitney South Sea Expedition were apparently refused permission to explore all islands of the Fiji group. It seems likely it may still exist there; Lt. Cdr. R. O. Morris informs me he has seen various dark petrels at sea there recently, but confusion is likely with the dark phase of the local race of Gould's Petrel *Pterodroma leucoptera brevipes*. At least it seems probable that if one of these species survives in the group, the other may as well.

(3) The Magenta Petrel *Pterodroma magentae*. This also is only known from a single specimen, taken at 39° 38' S. 125° 58' W. in the central south Pacific in 1866. I have recently reported (*Notornis* 11: 139) that it agrees in appearance, size and proportions with the Chatham Island Taiko

which bred in the interior of the main island of the Chatham group east of New Zealand well into this century. It seems quite possible that this and several other petrels still only known from the local bone deposits may also still survive undetected somewhere in this scattered and still apparently inadequately explored archipelago, or elsewhere in the subantarctic islands of New Zealand.

(4) Beck's Petrel *Pterodroma (rostrata) becki*. This is apparently still only known from the two specimens collected by the Whitney South Sea Expedition immediately north of the Solomons in 1929. Subsequent expeditions have failed to find either this or indeed any other petrel in the area at all, though since it resembles the sedentary tropical members of the genus it seems extremely likely to breed nearby. Indeed, Professor A. J. Cain and Dr. Ian Galbraith inform me (personal communications) that nocturnal birds which nest in burrows are reported locally to occur in the higher hills of the Solomons, which are comparatively undisturbed because they are the subject of tabus, and it seems likely that these may include *P. becki* among other petrels. Presumably its debatable status as an exceptionally small race of the Tahiti Petrel *Pterodroma rostrata* or a separate species will only eventually be settled by a comparison of the breeding behaviour, combined with sufficient exploration to show whether the latter, which breeds in the New Hebrides immediately to the south, breeds in the same area as *P. becki* as well.

(5) The Réunion Petrel *Pterodroma aterrima*. The status of this species, long confused with Jouanin's Petrel *Bulweria fallax* among other species, has already been reviewed by Jouanin (*Oiseau*, 25: 155, 27: 12). It is a highly distinct form still only known from four specimens all taken on Réunion before 1890, and it must breed there since two of the specimens (Paris B and Leiden) are immatures with incompletely grown quills. Since numerous other petrels still breed in the mighty cliffs of this formidable island it seems likely that *P. aterrima* does so as well; but I understand from M. Jouanin nobody has managed to find it again as yet. I have already suggested that it is also likely to be one of the petrels occurring in the St. Helena bone-beds as well.

(6) The Jamaica Petrel *Pterodroma caribbaea*. This appears to be a small dark race of the Capped Petrel *Pterodroma hasitata* only recorded from Jamaica, where it is the sole form reported. It is only known from a handful of specimens, of which I have seen nine, three in London, two in Paris, two in Harvard, one in New York and one in Stockholm. One in London is labelled "Hill, ex Gould, July '25", presumably 1825, while six of the others appear to belong to a batch collected by Edward Newton in the Blue Mountains in November 1879 and dispersed around the world, that at New York being labelled "Cinchona Plantation". There appears to be little or no information about the bird since that time, and it is usually assumed to have been wiped out by the introduced mongoose; but if the Capped Petrel can survive in Hispaniola, there seems no reason why this form should not do so in Jamaica; and indeed Captain G. S. Ritchie reports birds are still said to call at night in the Jim Crow mountains in the north-east of the island.

(7) Heinroth's Shearwater *Puffinus heinrothi*. This form is also only known from a handful of specimens from New Britain in the years immediately after the first world war, mainly from Uatom Islet off Rabaul.

In its general appearance and proportions it resembles Audubon's Shearwater *Puffinus lherminieri*, except that the underparts have become suffused with dark pigment leaving only small pale patches on the belly and underwing, while it has a long, slender bill. As with Beck's Petrel in the same area it seems likely that the final determination of its status must depend on further exploration to discover whether Audubon's Shearwater nests in the same area, and whether the two forms differ in their behaviour.

(8) The Guadalupe Storm-petrel *Oceanodroma macrodactyla*. This bird differs from the others because it has been collected freely in the past, but there is now more reason to suppose that it may really be extinct, as it has often been sought in vain since the last records fifty years ago (J. C. Greenway, 1958, *Extinct and vanishing birds of the world*. New York). The main colonies were originally on the middle slopes of an island off the west coast of Mexico which has now been so ravaged by introduced mammals that the vegetation is markedly altered and a whole series of endemic birds destroyed, mainly by cats. If it was really confined to these middle slopes there seems every reason to fear that the cats may have made a clean sweep of the whole colony. However, even here all hope need not necessarily be abandoned, since petrel chicks of uncertain identity have been reported on the island in recent years on offshore islets (T. R. Howell and T. J. Cade, *Condor* 56: 283, 58: 78), and as usual, even if these do not belong to the species in question, if one species survives, another might.

3 *Unexplored islands.*

A consideration of the number of petrels known from only a few ancient specimens whose present status remains obscure, and the larger number of others also only known from a few reports over a large part of their supposed range where it seems likely they are really common, provokes speculation as to what else is being overlooked. The recognised rarities are all local representatives of widespread groups, and five of the specific cases I quoted are gadfly petrels of the genus *Pterodroma* (a group which shows much local variation), one is a shearwater, and one a storm-petrel. If one considers the world distribution of these and some other groups of petrels, such as the prions and diving petrels of the far south, a number of conspicuous gaps in expected distributions become obvious, where according to all the laws of zoogeography the birds might be expected to occur.

Their absence can only be explained easily as the result of extermination or inadequate exploration. Not all these gaps necessarily once held additional species, since many fall within the expected range of recognised forms; but some may have done so; and in some cases the birds may still be found there if sought for, as with the Cahow on Bermuda, while in the others it should not be impossible to find at least their remains, as with the petrels of St. Helena.

Actually, it appears that petrels are far more likely to be overlooked than exterminated in any but the barest and simplest of sites, such as the naked peak of Guadalupe Island. Even in the British Isles the magnitude of the Manx Shearwater colonies of the south-west of Ireland and the Inner Hebrides was long overlooked in favour of more publicised sites,

so that it was possible to find a colony of the order of a hundred thousand birds flourishing forgotten on the mountain tops of Rhum (*Scot. Nat.* 69: 21). Elsewhere in Europe even now extraordinarily little seems to be known about the shearwater colonies down the Atlantic coast and in the Mediterranean, a matter of some importance to us because if any of the races of *Puffinus puffinus* should be found breeding close together in the area where their distribution at sea overlaps, along the west coast of Iberia or around Sardinia, Sicily and Tunisia, in the way now reported to occur with their local representatives in New Zealand (*Notornis* 12: 59), we may have to reconsider a passing suggestion by the two people who originally discovered it, the late H. F. Witherby and P. R. Lowe (*Bull. Brit. Orn. Cl.* 50: 83) that the Balearic Shearwater *Puffinus* (p.) *mauretanicus* should be treated as a distinct species, a new one for the British List.

In the Atlantic generally, the most important problem is the distribution of the gadfly petrels. Detailed information is still needed about the behaviour of the large and small forms of Soft-plumaged Petrel *Pterodroma mollis* nesting near each other at different seasons at Madeira (*Ibis* 99: 182), and their relationship to the typical form of Tristan da Cunha in one direction and the rather similar Cahow of Bermuda in the other; also the relationship of all these birds to the Capped and Jamaica Petrels of the Antilles. But such a comparison is still difficult without information on the gadfly petrels definitely known to have existed in the past at one intermediate site to the south, St. Helena, or those which must surely once have occurred at another intermediate site ideally suited for them to the west, the Azores. Rather little seems to be known about any of the petrels of the Azores yet (J. de Chavigny and N. Mayaud, *Alauda* 4: 133; N. Mayaud, *Alauda* 9: 313) and the most elusive group of all could easily have been overlooked here, especially if they nest, as they often do elsewhere, in the winter. Elsewhere in the Atlantic Audubon's Shearwater *Puffinus lherminieri* has so far only been recorded breeding in the north, but one specimen has been seen on Ascension, and what appear to be bones of this species have been found on St. Helena, while it has been seen in the Gulf of Guinea, so it may breed somewhere in this region, and quite possibly also on another likely site where no shearwater has yet been reported, South Trinidad, as well. The other shearwater reported from the St. Helena bone deposits, *Puffinus pacificus*, also may still occur there, among other species.

In the Indian Ocean the Mascarene Petrel *Pterodroma aterrima* seems likely still to occur undetected in the great cliffs of Réunion, together perhaps with other unrecorded species, and various petrels might also occur elsewhere in the Mascarene Islands, notably on the offshore reefs of Rodriguez, which provided British Museum specimens of Wedge-tailed Shearwaters in 1874, but have apparently never been investigated since, though terns at least still survive there (*Sea Swallow* 12: 9, 20). Further north in the Indian Ocean Jouanins' Petrel *Bulweria fallax* and the race *persicus* of Audubon's Shearwater must breed somewhere around the Arabian Sea, though there is still little indication where, except for reports of possible burrows on the Kuria Muria Islands and on islets at the mouth of the Persian Gulf (Roger Bailey and D. M. Neale *in litt.*); and the Wedge-tailed Shearwater may breed here as well, or in the Bay of Bengal, where the Andamans and Nicobars and islands along the south shores of

the East Indies also hardly seem to have been explored adequately yet.

However, the biggest problems occur in the Pacific, where only the periphery has received more than brief visits as yet. In the north the local petrel and shearwater have only recently been rediscovered, and the Madeiran Storm-petrel *Oceanodroma castro* still seems to be missing at Hawaii, which also lacks one of the smaller shearwaters normally characteristic of such groups elsewhere, though it seems unlikely that could have been missed (F. Richardson, *Bull. Bishop Mus.* 218: 1). It seems likely that many Hawaiian birds also occur further west, but there are still little more than vague hints as to what occurs in the great triangle between Hawaii, Japan and the East Indies, where the Whitney South Sea Expedition came to a halt among hostile Japanese mandates in the 1930s. At least the Hawaiian Shearwater has been recorded on Saipan, and the Black-footed Albatross *Diomedea nigripes* breeding on Agrigan, in the Marianas (C. Jouanin, *Bull. Mus. Nat. Hist. Nat. Paris* 28: 273, 31: 477), and the Hawaiian Petrel was collected on 17 February 1862 at Ternate in the Moluccas to the south (specimen at Leiden recorded in the literature as *P. leucoptera*). A well-defined race of Audubon's Shearwater, *bannermani*, also occurs here, together with the little-known Matsudeira's Storm-petrel *Oceanodroma matsudeirae*, perhaps quite extensively if as suggested by R. Bailey it winters south to the Indian Ocean (*Ibis* 107: 134).

The central tropical Pacific is rather better known because it was worked extensively by the Whitney Expedition, but even so there are still many mysteries, especially where the petrels breed in the inaccessible volcanic mountain summits of groups such as the Solomons and New Hebrides, Fiji, Samoa, Tahiti and the Marquesas along the equator. I have already cited Heinroth's Shearwater and Beck's and the Fiji Petrels among the little-known species occurring here, to which may be added the lost dark phase of the White-throated Storm-petrel *Nesofregetta f. fuliginosa* from Samoa and perhaps Tahiti (*Bull. Br. Orn. Cl.* 77: 40). Further south most of the islands have also at least been visited, but often only at one season, usually in the southern summer, so that out-of-season breeders such as the Little Shearwater may easily have been overlooked at such sites as the Juan Fernandes group, Easter or the Tubuai Is., or the Magenta Petrel among a variety of species known only from the bone middens on the Chatham Islands, to quote only one of the many archipelagoes around New Zealand, where the development of the petrels as a group reaches a climax.

Comparatively few petrels occur in northern and tropical seas, so it is unlikely to overlook species among their allies once the breeding sites have been discovered, though this may be difficult where they are situated on remote rocks offshore, in coastal or inland cliffs, or on remote mountain tops inland. The situation is different in the huge intermingled petrel colonies of the subantarctic islands of the Southern Ocean, where the number of species present may run into dozens, involving complexes of sibling species whose members breed together, as with the diving petrels, prions, some storm-petrels, gadfly petrels and albatrosses, and even perhaps the giant petrels (W. R. P. Bourne and J. Warham *Ardea* in press). The full variety of species present, especially the smaller ones, may be hard to determine here even in undisturbed colonies. Where the birds have been reduced in numbers and driven to inaccessible sites by

introduced predators, as is now unfortunately usually the case, and these have to be searched in the climate of perpetual high seas, rain and gales characteristic of the West Wind Zone, it becomes easy to understand why at virtually every site there are species known only from occasional specimens whose status remains obscure, while other obvious possibilities for the local list have not yet been found at all.

However, difficult as it may be to investigate the breeding sites in the far south, the birds are usually well-enough known if only because the gales blow them ashore on mainland coasts. It is among the scattered archipelagoes of lower latitudes that they may be really hard to discover.

4. *Conservation.*

The petrels have evolved adaptations for a naturally secure environment, feeding far out at sea and breeding on oceanic islands devoid of natural ground predators, so that their numbers are normally more likely to be limited by such factors as overcrowding, starvation, disease and natural casualties, notably volcanic eruptions, at the breeding places, than predation. In consequence they have suddenly been exposed to a series of unnatural hazards as man has systematically colonised the oceanic islands of the world, bringing with him a new flora and fauna.

This may affect the birds in a number of ways. First, the one which still receives too little attention, is the influence of introduced herbivores on the physical character of the environment. It can be seen well at some British seabird colonies, such as St. Kilda. If these are left undisturbed the birds plough the ground with their burrows and fertilise it with their excrement until a distinctive breeding habitat is formed, with the soil riddled with holes and covered with a tall, rank growth of loose herbage in which the birds can hide from their natural predators, other birds. As soon as large mammalian herbivores are introduced they clear this surface herbage and tread the ground hard so that the birds can neither burrow nor hide there. Owing to the uncontrolled proliferation of flocks of sheep, the three main islands of the St. Kilda group are now covered with a fine short greensward, on a firm base, and the burrowing seabirds for which the islands are famous are restricted to the steeper slopes and lesser islets. Uncontrolled, the sheep multiply till at intervals famine supervenes, and then die; gulls are increasing, and the slopes are covered with castings containing storm-petrel bones, the eviscerated skins of shearwaters and Puffins, and the remains of dead sheep. Even if this unkind experiment by Nature Conservancy personnel is really necessary, it seems regrettable it should be carried out in the privacy of our best seabird colony.

The remainder of the process may be illustrated by the tale of the Cahow on Bermuda, as elucidated by Mowbray, Murphy and Wingate (*loc. cit.*). At the time of their discovery at the end of the sixteenth century the islands were covered with seabird colonies, including terns, several petrels and a tropic-bird. The first visitors introduced hogs, and any seabirds these left on the main islands the first hungry colonists finished off, reducing the petrels in particular to an insignificant remnant on the outer rocks. Here they bred forgotten and unmolested for three centuries, until during the last war airfield extensions began to infringe their habitat, and an expedition was mounted at the last minute to save them, probably too late to save one and possibly both shearwaters, but just in time to relieve the last ageing Cahows. These were probably suffering some persecution

from rats, but in point of fact it was not these but another bird, the tropic-bird, which proved the main hazard. Of pleasant appearance and fierce disposition, it had proved capable of charming men and intimidating rats where petrels failed, and was now multiplying to such an extent that a constant stream of prospecting birds seeking nest sites were visiting the Cahow's holes at the time when they first desert their small young by day, killing them.

In fact, it appears that while the first effects of the introduction of mammals to seabird breeding stations is destruction of the habitat and the progressive devastation of accessible breeding colonies, the long-term consequences may be rather different; first the restriction of the colonies to inaccessible sites, and the multiplication of the birds there, and then, if the area available is small, the progressive eviction of weaker birds from the better sites by stronger ones. Species may be exterminated at any stage in this process; by predation, through the destruction of their habitat, whether on the breeding ground, or through oiling or the depletion of fisheries at sea, or through competition with other species in a reduced area of safe habitat. Detailed study is required to discover in what way they may be threatened, and how it can be counteracted, because the situation may be very different with different species. In point of fact it seems likely that the majority of the missing petrels, while reduced in numbers, may be in no immediate danger at all. But with others the situation may be critical, and the judicious use of a protection order, a warden, a length of wire netting, a few artificial nest sites, or a gun against their enemies might still save them. But for this we still need to know more about them.

Summary.

A survey is made of a number of the petrels and their breeding places for which there is little information, and the hazards which may affect their welfare there.

(The suggestion that the Manx Shearwater may need to be split into several species aroused some comment in the discussion, while scepticism was expressed at the idea there may still be new petrels to be discovered, notably in the Azores.)

Annual General Meeting

The seventy-third Annual General Meeting of the British Ornithologists' Club was held at the Rembrandt Hotel, London, at 6 p.m. on Tuesday 20th April 1965 with Major-General C. B. Wainwright in the chair.

The minutes of the last Annual General Meeting held on 28th April 1964 were confirmed. The minutes of the Special General Meeting held on 14th December 1964 were read and confirmed. Arising from the latter meeting, at which members had approved a recommendation by the Committee that the bequest of the tenancy of a house at Tring should be accepted, and that money received under the same bequest should be used to set the house in order, it was stated that the Trustees of the estate had now informed the Club that, in spite of earlier statements, no money had been bequeathed to it. In spite of this the committee considered that it was in the interest of the Club that it should accept the tenancy, and the method of raising the money required was now under consideration.